Original Article

# Phytochemical, physicochemical, and fatty acids composition analyses of four species of *Ficus* genus from the arid zone of Rajasthan

Ram Lal Saini, Seema Parveen, Rajni Bais, Mohammed Taufeeque

Department of Chemistry, Jai Narain Vyas University, Jodhpur, Rajasthan, India

## Abstract

**Background:** With the advancement of the oilseed economy, there is a great deal of interest in using unusual and underexploited sources of seed oils. The seed oils of different species of *Ficus* genus are well known for their nutritional and medicinal potential.

**Aims:** The aim of the present research work is to investigate the phytochemical, physicochemical, and fatty acids composition of the seed oil from four different species of *Ficus* genus from the arid zone of Rajasthan with a view to analyze their nutritional and therapeutic potential.

**Materials and Methods:** The seed oils of *Ficus benghalensis*, *Ficus benjamina*, *Ficus carica,* and *Ficus racemosa* were extracted by soxhlet extraction technique using petroleum ether as a solvent. The fatty acid methyl esters were obtained by transesterification process and their fatty acid profiles were studied by gas chromatography-mass spectrometry technique.

**Results:** The phytochemical analysis showed carbohydrate, flavonoids, alkaloids, terpenoids, and tannin in the seed oil of these *Ficus* species. The study suggested the presence of unsaturated fatty acids in *F. benjamina* (71.72%), *F. racemosa* (70.44%), *F. carica* (59.00%), and *F. benghalensis* (55.32%).

**Conclusion:** The major amount of polyunsaturated fatty acids in *F. benjamina* (60.81%) and alpha linolenic acid in *F. carica* (12.74%) indicates their nutritional and medicinal values.

**Keywords:** Fatty acids analyses, *Ficus* genus, phytochemical composition

**Address for correspondence:** Dr. Seema Parveen, 120 Nai Sarak, Jodhpur - 342 001, Rajasthan, India.
E-mail: seemakhan2831@gmail.com

**Submitted:** 07-Mar-2021 **Revised:** 12-May-2021 **Accepted:** 27-May-2021 **Published:** 26-Aug-2021

## INTRODUCTION

The genus *Ficus* belonging to the family *Moraceae* is classified among the biggest genera of dicotyledons with approx. Eight hundred species of woody trees including shrubs found globally in the tropic and sub-tropics areas.[1] They are also known as fig trees. About 500 *Ficus* species are found mainly in Asia and Australia. The genus consists of many varieties with considerable genetic diversity and excellent pharmaceutical activities that are of terrific trade value.[2] The *Ficus* species are widely known for their use as traditional medicines. Its species have been recognized as a major source of phenolic acid and flavonoids which lead them to be useful in the treatment of oxidative stress disorders.[3] Plant extracts obtained from Ficus species have been found to be useful in the treatment of stomach pain, cancer, hemorrhoids, gastric ulcer, diarrhea, various other inflammation, and long-term oxidative stress.[4] *Ficus* species are also biologically active as they showed anti-cancer, anti-diabetic, and anti-inflammatory properties.[5] In the present study, seeds from

| Access this article online | |
|---|---|
| Quick Response Code: | Website: www.ijfans.org |
| | DOI: 10.4103/ijfans.ijfans_12_21 |



**How to cite this article:** Saini RL, Parveen S, Bais R, Taufeeque M. Phytochemical, physicochemical, and fatty acids composition analyses of four species of *Ficus* genus from the arid zone of Rajasthan. Int J Food Nutr Sci 2021;10:26-9.

four plant species; *Ficus benghalensis, Ficus benjamina, Ficus carica,* and *Ficus racemosa* belonging to *Moraceae* family were investigated for their phytochemical, physicochemical properties and fatty acid compositions using chemical, chromatographic, and spectroscopic techniques. The increased intake of saturated fats is allied with cardiovascular disease, which is the leading global cause of 30% of mortality in modern society.[6] Currently, omega-3 ($\omega^{-3}$) and omega-6 (ω-6) polyunsaturated fatty acids (PUFAs) are highly desired ingredients in oil with unique dietary and functional characteristics. To enhance and sustain human health over the entire lifespan, PUFA is considered essential active mediators, but only the cardiac effect has been widely stated. In recent times, omega-3 fatty acids have been shown to perform a valuable role in the treatment of severe human diseases, particularly obesity and type 2 diabetes mellitus, in addition to this PUFA are also attributed with a reduced rate of stroke, atherosclerosis, and cardiac problems. Omega-3-Alpha-linolenic fatty acids (ALA) are required for normal health, especially for the brain development and function,[7] Nicolas B *et al*., has suggested that ALA has anti inflammatory and other potential beneficial properties therefore it may reduce stroke risk, size, and/or consequences. [8] Many countries in their dietary guidelines promoted intake of PUFA[9] such as Dietary Guidelines for Americans,[10] American Heart Association,[11] and Brazilian Society of Cardiology.[12] Recently, in economically advanced countries oil rich in unsaturated fatty acids are usually recommended in contrast to saturated fats.[13] With a view to figure out the nutritional value and therapeutic potential of the four Ficus plant species, in the current research, their seed oils were extracted and their phytochemical, physicochemical, and fatty acid compositions were analyzed.

## MATERIALS AND METHODS

### Sample collection

In the present study *F. benghalensis, F. benjamina, F. carica,* and *F. racemosa* seeds were collected from the Jodhpur district of Rajasthan (India). The fresh seeds samples were dried in shade and grounded to fine powder. One-half of the seeds were used for phytochemical analysis and the rest for extraction of oil from seeds.

### Premilinary phytochemical analyses

#### *Extraction*

Twenty gram of powdered seeds were dissolved in 100 ml of methanol. Methanolic extract of seeds was obtained using shaker system for about 48 h. The seed extract of all the four plant species was tested for the presence of carbohydrates, proteins, amino acids, steroids, glycosides, flavonoids, alkaloids, tannins, saponins, terpenoids, and resins. The phytochemical analysis of the methanolic extracts is carried out using standard methods shown in Table 1.[14-16]

#### *Physico-chemical analyses*

The rest halves of the grounded seeds were weighed.

#### *Moisture content*

Weighed amount of fresh grounded seeds samples were taken then it was placed in a hot air oven for about an hour for 1000C and the dry weight of the seeds sample become constant.

**Table 1: Phytochemical analysis of *Ficus* species**

| Phytochemical constituents | *Ficus benghalensis* | *Ficus benjamina* | *Ficus Carica* | *Ficus racemosa* |
|---|---|---|---|---|
| Carbohydrate | + | + | + | + |
| Amino acids | - | - | - | - |
| Starch | + | + | + | + |
| Flavonoid | + | + | + | + |
| Alkaloids | + | + | + | + |
| Tannin | + | + | + | + |
| Saponins | - | + | - | - |
| Terpenoids | + | + | + | + |
| Glycosides | - | + | - | - |
| Steroids | - | - | - | - |

+: Presence of compound; -: Absence of Compound

$$\text{Moisture } \% = \frac{\text{weight of fresh seeds} - \text{weight of dried seeds}}{\text{weight of fresh seeds}} \times 100$$

#### *Extraction of oils*

Oils were extracted using the soxhlet apparatus and petroleum ether (40–600C) as a solvent. The rotary evaporator was used to evaporate the remaining solvent in vacuum. The standard methods of American Oil Chemist's Society (AOCS) were employed to find out the analytical values of oil seeds.[17] Fatty acids methyl esters (FAMEs) of the seed oils were prepared using the transesterification process.

#### *Refractive indexes*

Abbe's refractometer was used to determine (Refractive index [R. I] value) of the oils. The Kjeldahl method was adopted to evaluate protein content from defatted seeds.

#### *Saponification value*

One gram weighed oil samples were reacted with 50 ml of 4% alcoholic KOH solution then refluxed it for about 3–4 h. Further, titrate it with 0.5N NaOH solution. Phenolphthalein is used as an indicator. A blank determination was also performed simultaneously.

#### *Iodine value*

Wiz's method is adopted to elucidate the iodine values of the seed oils. In a round bottom flask, 1 g of oil samples + 25 ml Wiz's solution + 25 ml carbon tetrachloride were reacted. Then, it was kept in dark for about 30–40 min. Thereafter, 20 ml of 15% KOH + 100 ml of water were added to this mixture. The iodine was liberated which then made to titrate against 0.1N Hypo solution. One percent of starch solution used as an indicator. Along with this, a blank titration was also performed.

### Analytical techniques

#### *Thin layer chromatography*

The thin layer chromatography was performed using silica gel G as an adsorbent material. Hexane-diethyl ether-acetic acid in the ratio of (80:20:1) was used as a mobile phase. The sample spots were observed under an iodine chamber.

#### *Gas chromatography-mass spectrometry*

Thermo scientific TSQ 8000 Gas chromatography-mass spectrophotometer used for analyses of FAMEs of the *Ficus* species. The carrier gas was helium with a flow rate of 1 mL/min. The injector and detector temperature were maintained at 250°C and 260°C, respectively. The initial temperature of the oven was 80°C and

raised up to 200°C then further increased to 250°C with increase rate of 8°C–10°C/min. A capillary column of polysilphenylene-siloxane was used.

## RESULTS AND DISCUSSION

The results of the qualitative screening of *Ficus* species in methanolic extract of seeds are shown in Table 1. The results indicated the presence of biologically active chemical components in the seeds of all the four *Ficus* species. The phytochemical compounds such as carbohydrates, starch, flavonoid, alkaloid, tannin, and terpenoids are found in the methanolic extract of all the four species. Amino acids and steroids were completely absent in all the *Ficus* species. Saponin was found only in *F. benjamina* and *F. racemosa*. The oil percentages in the *Ficus* species were ranging from 12.34% to 17.23%. *F. benghalensis* showed the highest percentage of protein (10.62%). *F. carica* showed the highest percentage of moisture (9.71%). All the four *Ficus* species were found to have high saponification values ranging 190.77–203.24. The Iodine values for *F. benghalensis*, *F. benjamina*, *F. carica,* and *F. racemosa* were found 89.67, 76.92, 99.07, and 106.34, respectively. The R. I values for the *Ficus* species seeds oils were found in between 1.47 and 1.48. The Gas chromatography–mass spectrometry analysis of fatty acids in the oils from seeds of *Ficus* species have been recorded in Figures 1a, b and 2a, b. The identification of saturated and unsaturated fatty acid in all the Ficus species was performed by comparing its retention time with that of standards lipids. Different types of unsaturated and saturated acids were found in these seed oils. Among the unsaturated fatty acids, linoleic acid was reported in the highest amount (55.42%) in *F. benjamina* and Alpha-Linolenic acid ($\omega^{-3}$) was observed in moderate amount (12.74%) only in *F. carica*. The unsaturated fatty acids were reported in significant amounts in all the above-mentioned *Ficus* species varied from 55.32% to 71.72%. The PUFA was found in the major amount in *F. benjamina* (60.81%) given in Table 2. From the preliminary qualitative phytochemical screening of *Ficus* species seeds extracts, it was found that their methanolic extract possessed maximum quantity of secondary metabolites. Akanni *et al.* mentioned that seed oils with high saponification values are important from the industrial point of view,[18] as they played crucial role in soap and cosmetic industries which further favors the industrial potential of these *Ficus* species seed oils. Researchers have reported that oils having saturated fatty acids in majority showed low iodine values, while oils having unsaturated fatty acids in majority have high iodine values.[19] The significantly higher iodine values of these Ficus species account for their good percentage of unsaturated fatty acids. Similar to the study of Emine Nakilcioglu tas *F. carica* was found to have a higher proportion of Unsaturated Fatty Acids (UFA) than Saturated Fatty Acids (SFA).[20] Emine in his research also suggested that fig seeds have a crucial role in human health due to their rich nutritional content. On contrary to the findings of Lahcen and *et al*.[21] and Ozge *et al*.[22] in *F. carica* seed oil we have found higher percentage of linoleic acid (18:2) than linolenic acid (18:3), but the presence of Alpha-linolenic acid ($\omega^{-3}$) was in fare agreement with both of them.

## CONCLUSION

On account of high saponification value, all these four species of Ficus have industrial significance. The higher amount of unsaturated fatty acids and polyunsaturated fatty acids in *F. benjamina, F. racemosa,* and the presence of Alpha-linolenic acid ($\omega^{-3}$) in *F. carica* made them valuable for human nutrition and medicinal point of view. The presence of phytochemical bioactive compounds which include flavonoids, terpenoids, alkaloids, and tannin in all these species furnishes their importance from nutritional and pharmaceutical perspectives. This research provides a base for further analyses of *Ficus* species for their phytochemical and nutritional characteristics.

**Table 2: Cumulative fatty acid composition**

| Name of *ficus* species | Total SFA (%) | Total UFA (%) | PUFA (%) |
|---|---|---|---|
| *Ficus benghalensis* | 44.68 | 55.32 | 39.91 |
| *Ficus benjamina* | 28.27 | 71.72 | 60.81 |
| *Ficus carica* | 41.00 | 59.00 | 34.91 |
| Ficus *racemosa* | 17.45 | 70.44 | 40.13 |

SFA: Saturated fatty acid, UFA: Unsaturated fatty acid, PUFA: Polyunsaturated fatty acid

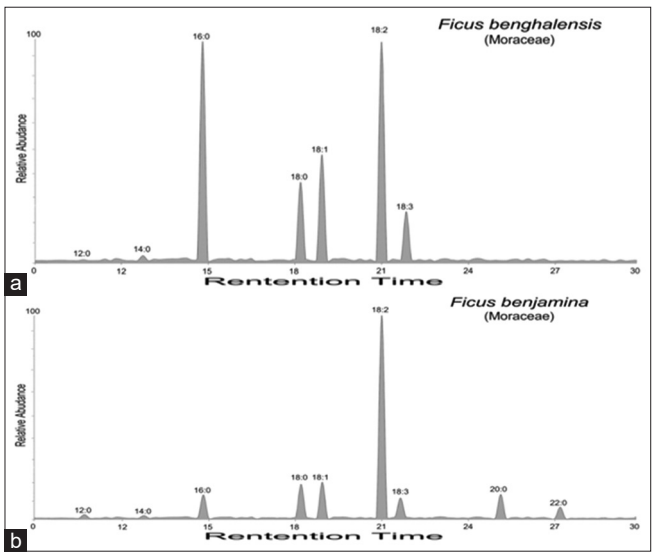


**Figure 1:** Gas chromatography–mass spectrometry graphs for (a) *Ficus benghalensis* (b) *Ficus benjamina*

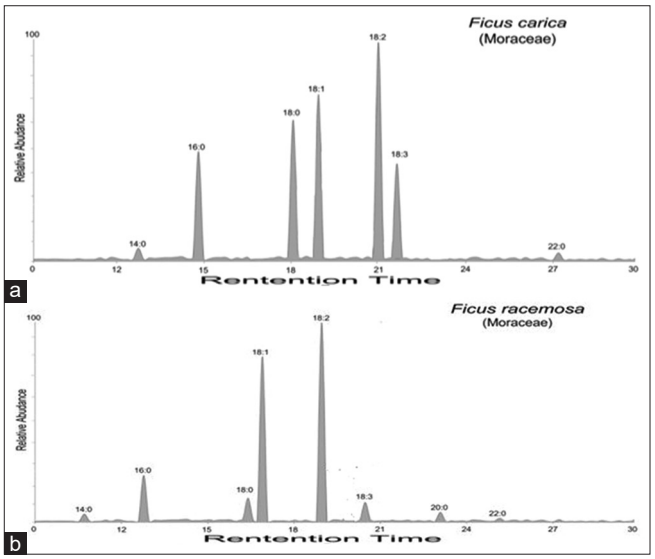


**Figure 2:** Gas chromatography-mass spectrometry graphs for (a) *Ficus carica* and (b) *Ficus racemosa*

## Acknowledgment

We are thankful to the Head of the Department of Chemistry, Jai Narain Vyas University for providing the necessary assistance and also to Professor (Dr.) Pawan Kasera for identification of plants.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

## REFERENCES

1. Singh D, Singh B, Goel RK. Traditional uses, phytochemistry and pharmacology of *Ficus religiosa*: A review. J Ethnopharmacol 2011;134:565-83.
2. Woodland DW. Contemporary Plant Systematics. 2nd ed. Berrien Springs, MI: Andrews University Press; 1997.
3. Sirisha N, Sreenivasulu M, Sangeeta K, Chetty CM. Antioxidant properties of *Ficus* species – A review. Int J Pharm Tech Res 2010;2:2174-82.
4. Joseph B, Raj SJ. Phytopharmacological and phytochemical properties of three *Ficus* species – An overview. Int J Pharma Bio Sci 2010;1:246-53.
5. Khedra AI, Sabrin RM, Ibrahim SR, Mohamed GA, Ross SA, Yamada K. Panduramides A D, new ceramides from Ficus pandurata fruits. Phytochem Lett 2018;23:100-5.
6. Mensink RP, Zock PL, Kester AD, Katan MB. Effects of dietary fatty acids and carbohydrates on the ratio of serum total to HDL cholesterol and on serum lipids and apolipoproteins: A meta-analysis of 60 controlled trials. Am J Clin Nutr 2003;77:1146-55.
7. Bourre JM, Dumont O, Piciotti M, Clément M, Chaudière J, Bonneil M, *et al*. Essentiality of omega 3 fatty acids for brain structure and function. World Rev Nutr Diet 1991;66:103-17.
8. Nicolas B, Robert HL, Miled B, Mark WD, Philip BG, Ann MM. Alpha-linolenic acid: An omega-3 fatty acid with neuroprotective properties – Ready for use in the stroke clinic? Biomed Res Int 2015;2015:1-8.
9. Sokoła Wysoczańska E, Wysoczański T, Wagner J, Czyż K, Bodkowski R, Lochyński S, *et al*. Polyunsaturated fatty acids and their potential therapeutic role in cardiovascular system disorders – A review. Nutrients 2018;10:1561.
10. U.S. Department of Agriculture and U.S. Department of Health and Human Services. Dietary Guidelines for Americans 2010. 7th ed. Washington, DC: Government Printing Office; 2010.
11. Eckel RH, Jakicic JM, Jamy DA, Van SH, Janet MJ, I Min L, *et al*. 2013 AHA/ACC Guideline on lifestyle management to reduce cardiovascular risk: A report of the American College of Cardiology/ American Heart Association task force on practice guideline. Circulation 2014;129;S76-S99.
12. Santos RD, Gagliardi AC, Xavier HT, Magnoni CD, Cassani R, Lottenberg AM, *et al*. First guidelines on fat consumption and cardiovascular health. Arq Bras Cardiol 2013;100 1 Suppl 3:1-40.
13. Aranceta J, Perez C, Mataix J. Dietary reference intakes, nutritional goals and dietary guidelines. In: Pérez C, Gil A, Serra L, editors. The White Paper in Omega 3. Madrid, Spain: Editorial Medica Panamericana; 2013. p. 83.
14. Raman N. Phytochemical Techniques. 1st ed. New Delhi: New India Publishing Agency; 2006. p. 19-24.
15. Karpagam N, Naveen Prasad R, Vasanthi N. A antimicrobial and phytochemical screening of Solanum torvum. Herbal Technol Ind 2008;1:20-45.
16. Kokate CK, Purohit AP, Gokhale SB. Text Book of Pharmacognosy. 3rd ed. Pune: Nirali Prakashan; 2001.
17. American Oil Chemist's Society. Official and Tentative Methods of the American Oil Chemists Society. Champaign, Illinois: AOCS; 1964.
18. Akanni MS, Adenkule AS, Olugemi EA. Physicochemical properties of some non-conventional oilseeds. J Food Technol 2005;3:177.
19. Bennion M. Introductory Foods. New Jersey: Prentice-Hall Inc.; 1995. p. 10.
20. Nakilcioglu TE. Biochemical characterization of Fig (*Ficus carica* L.) seeds. J Agric Sci 2019;25:232-7.
21. Lahcen H, Hafida H, Jamal C, Rachid R, Abderraouf E, Said E, *et al*. First report on fatty acids composition, total phenolics and antioxidant activity in seeds oil of four fig cultivars (*Ficus carica* L.) grown in Morocco. Oilseeds & Fats Crops and Lipids (OCL) 2020;27:1-10.
22. Nefise B, Ozge K, Rana N, Ozlem C. Medicinal and nutritional analysis of fig (*Ficus carica*) seed oil; A new gamma tocopherol and omega-3 source. Prog Nutr 2021;23:1-6.